

ACCESSION #: 9808260104

NON-PUBLIC?: N

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Davis-Besse Unit Number 1 PAGE: 1 OF 16

DOCKET NUMBER: 05000346

TITLE: Tornado Damage to Switchyard Causing Loss of Offsite
Power

EVENT DATE: 6/24/98 LER #: 1998-006-00 REPORT DATE: 08/21/1998

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION:

50.73(a)(2)(i), 50.73(a)(2)(iii), 50.73(a)(2)(iv), & 50.73(a)(2)(v)

LICENSEE CONTACT FOR THIS LER:

NAME: C. A. Kraemer, Engineer - Licensing TELEPHONE: (419) 321-7153

COMPONENT FAILURE DESCRIPTION:

CAUSE: C SYSTEM: EA COMPONENT: CON MANUFACTURER:

X SB TD

X EK CDMP

A EB 52

C IL 45

X EK HS

REPORTABLE TO EPIX: N

N

N

Y

Y

N

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On June 24, 1998, at approximately 2040 hours, with the unit in Mode 1 at 99 percent power, a storm cell moved through the site area, and, at approximately 2044 hours, a tornado touched down onsite. The Emergency Diesel Generators were both manually started when the Control Room received a report of a tornado on site. The damage from the tornado, accompanying straight-line winds, rain and lightning, resulted in a complete loss of offsite power (LOOP). The LOOP caused the turbine control valves to close in response to a load rejection by the main generator. The Reactor Protection System (RPS) initiated a reactor trip on high Reactor Coolant System (RCS) pressure. At 2118 hours, an Alert was declared in accordance with procedure RA-EP-01500, Emergency Classification, Emergency Action Level (EAL) 8.B.2, Any tornado striking facility. Following restoration of an offsite power source, the Alert was downgraded to an Unusual Event at 0200 hours on June 26, 1998, and at 1405 hours, the Unusual Event was terminated. The tornado resulted in significant damage to the offsite electrical distribution system, telecommunications, power to the sirens and other unfortified structures. Immediate corrective actions involved the testing and repairing of the affected electrical and mechanical equipment necessary to restore two offsite power sources and assessing damage to other plant components and structures and initiating repairs. Plant telecommunications were restored and the siren system was returned to 90 percent availability prior to plant startup. There were no adverse effects to the public health or safety. Davis-Besse Nuclear Power Station Unit 1 startup was initiated, with reactor criticality reached on July 1, 1998, at 2257 hours, but was shutdown due to elevated sulfate levels in the steam generator water chemistry on July 2, 1998. Following steam generator fill, soak and drains, startup was initiated on July 5, 1998, and at 0400 hours on July 7, 1998, the Main Generator was synchronized to the grid.

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Component Failure Description appended to Ler Form

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Description of Occurrence:

(Reference Attachment 1, Sequence of Events)

On June 24, 1998, with the unit in Mode 1 at approximately 99 percent power, plant personnel were restoring from the Auxiliary Feedwater Pump 1 (AFP) [Energy Industry Identification System identifier:BA] maintenance outage and were preparing to perform the quarterly AFP Surveillance Test, when at approximately 2040 hours, air circuit breakers [52] in the 345 kilovolt (kV) switchyard opened, potentially due to lightning strikes. Switchyard air circuit breaker (ACB) 34561 opened and breaker ACB 34562 opened and closed several times until it remained open (Reference Attachment 2, Switchyard). At approximately 2044 hours, Security personnel notified the Shift Supervisor that a funnel cloud had been spotted in the vicinity of the Cooling Tower [CTW]. Once notified of the funnel cloud, control room operators commenced starting of the Emergency Diesel Generators (EDGs) [EK-DG]. The EDG 2 was started from the Control Room at 2044 hours, but the EDG 1 failed to start from the Control Room. The EDG 1 was successfully started locally at 2046 hours.

At 2047 hours tornado damage to the switchyard resulted in a complete loss of offsite power (LOOP). The damage to the switchyard components and transmission lines caused the Main Generator [EL-GEN] to be disconnected from the distribution grid. This, in turn, initiated a Power Load Unbalance runback of the Turbine [TRB], causing a primary to secondary heat transfer mismatch which caused an increase in Reactor Coolant System (RCS) [AB] pressure, resulting in the Reactor Protection System (RPS) [JC]

tripping the reactor on high RCS pressure. The Steam Feedwater Rupture Control System (SFRCS) [JB] actuated the AFP to supply Auxiliary Feedwater to the Once Through Steam Generators (OTSG) [SG]. At this same time, 2047 hours, the Plant Computer System failed because of the loss of power to electrical distribution panel YAU (SWGR).

Personnel accountability was performed and damage assessment ensued. At 2058 hours, it was discovered that the Turbine roof had a large hole (estimated to be 8 feet by 20 feet) and that several turbine roof vents had been ripped off and that rainwater was entering these areas. An Alert was declared at 2118 hours in accordance with procedure RA-EP-01500, Emergency Classification, Emergency Action Level (EAL) 8.B.2, Any tornado striking facility. The Control Room attempted to make the required notifications but it became apparent that there had also been severe damage to the telecommunications system [FI]. Ottawa County was notified at 2124 hours. Contact with Lucas County was made at 2128 hours, but notification was not completed. Attempts were made to notify the State of Ohio, but were unsuccessful. The notification of the State of Ohio was deferred to the Nuclear Regulatory Commission (NRC) during the NRC notification at 2136 hours. There had been a failure of two of the three available telephone systems that service DBNPS (fiber optic and copper lines). Only the microwave system remained operational. Phones not functioning included: the 4-way ring down to state and counties, the NRC Red Phone, and the phones lines connected to the Computerized Automatic Notification System

(CANS) which is utilized to call out the Emergency Response Organization (ERO).

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Description of Occurrence: (Continued)

At 2230 hours, the initial switchyard [FK] damage report indicated that there was substantial damage, which included the following (Reference Attachment 2): ABS 34620 had one broken connector [EA-CON], ABS 34621 had two broken connectors, ABS 34622 had one broken connector and ABS 34623, 34624 and 34625 were also damaged. This damage resulted in the loss of all three offsite power sources: Bayshore, Lemoyne and Ohio Edison lines. At 2238 hours, the plant entered Technical Specification (TS) 3.8.1.1 Action d, to restore at least one of the inoperable offsite sources within 24 hours. At this time, the unit was in HOT STANDBY and both EDGs were supplying their essential loads.

The Operations Support Center (OSC) was activated at 2322 hours, the Technical Support Center (TSC) was activated at 2338 hours and the Emergency Control Center (ECC) was activated at 2348 hours.

At 2353 hours with the plant in Mode 3 with RCS pressure at 2265 pounds per square inch gauge (psig) and RCS temperature at 540 degrees Fahrenheit (F), due to the loss of offsite power and the subsequent loss of forced cooling, a natural circulation cooldown was commenced in accordance with procedure DB-OP-06903, Plant Shutdown and Cooldown. The Atmospheric Vent Valves (AVVs) [SB-PCV] were opened by the operators to control steam pressure.

Other equipment anomalies that occurred subsequent to the LOOP and reactor trip included: various meteorological tower [IS] data points were not available and Loop 2 Atmospheric Vent Valve (AVV 2) could not be controlled in automatic.

As part of the area damage assessment, the Prompt Notification System (PNS) sirens were tested. At 0900 hours on June 25, 1998, 26 out of a total of 54 sirens did not respond when polled from the ECC. All of the PNS sirens that did not respond were located in Ottawa County. Ottawa County officials were notified of these results.

At 1035 hours on June 25, 1998, EDG 1 room temperature exceeded 120 degrees F and in accordance with the procedural operating limits EDG 1 was declared inoperable and the plant entered TS 3.0.3. The EDG 1 room ventilation recirculation damper [EK-CDMP] was found to be in the open position. The recirculation damper was placed in the closed position and at 1232 hours, EDG room temperature decreased below 120 degrees F, EDG 1 was declared operable and the plant exited TS 3.0.3.

At 1313 hours, with the recirculation damper closed, the EDG 1 room temperature again increased above 120 degrees F and EDG 1 was again declared inoperable and the plant re-entered TS 3.0.3. Supplemental cooling to EDG 1 was provided by installing portable fans and by opening doors. At 1530 hours, EDG 1 room temperature decreased to 116 degrees F and remained below 120 degrees F while EDG 1 continued to operate until it was shutdown at 2153 hours on June 25, 1998. The EDG 1 remained inoperable

pending engineering evaluation, but did continue to run and provide emergency power.

At 1913 hours on June 25, 1998, it was determined that the requirement of TS 3.0.3 to be in hot shutdown within the timeframe specified by the TS could not be met due to procedural restriction on cooldown rate. The Shift Supervisor invoked the provisions of 10CFR50.54(x), emergency departure from technical specifications. The NRC was notified in accordance with 10CFR50.72(b)(1)(i)(B) of this event at 2020 hours.

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Description of Occurrence: (Continued)

At 1926 hours on June 25, 1998, the first offsite source, the Ohio Edison line, was restored. Subsequently, at approximately 2100 hours when Operations attempted to transfer 4.16 kV busses C1/C2 supply from EDG 1 to the BD bus tie transformer [XMFR], ABDC1 [EB-52] failed to close.

Operations performed a dead bus transfer of the C2 bus to the AC bus tie transformer via circuit breaker AACC2, then performed a live transfer of C1 to C2 bus via circuit breaker AC110.

On June 25, 1998, at approximately 2330 hours, following the restoration of the Ohio Edison line, EDG 2 shutdown was initiated and D1 bus was energized from X02 transformer. The EDG 2 was unloaded without difficulty. The output breaker AD101 was opened and EDG 2 speed reportedly increased from 900 to 970 revolutions per minute (rpm) due to the Governor Control [65] switching out of Electric Control to Hydraulic Control. Using the local

speed changer, the EDG 2 speed was set to 900 rpm; the normal stop button was pressed and the diesel shutdown normally. At this time, 2335 hours on June 25, 1998, EDG 2 was declared inoperable due to an apparent problem with the governor control. At 2335 hours with the Ohio Edison line declared operable, the first TS 3.8.1.1 action d requirement, return one offsite source to operable within 24 hours, was completed. The plant remained in TS 3.0.3 due to two EDGs inoperable and one offsite source inoperable.

At 0200 hours on June 26, 1998, the Emergency Director in accordance with procedure RA-EP-01500 under E.A.L. 9.2, downgraded from an Alert to an Unusual Event. The NRC was notified at 0300 hours.

At 0340 hours on June 26, 1998, EDG 1 was declared operable based on an engineering evaluation and EDG 1 room temperature less than 120 degrees F. The plant exited TS 3.0.3 and entered TS 3.8.1.1 action c, with one offsite circuit and one diesel generator inoperable.

On June 26, 1998, at 1130, the second offsite source (Lemoyne line) was declared operable but the plant remained in TS 3.8.1.1 Action c because EDG 2 was still inoperable.

At 1240 with Station Vent Radiation Element RE 4598 AA [IL-45] out of service for calibration, Station Vent RE 4598 BA was declared inoperable due to water intrusion causing intermittent spiking. The CREVS was manually initiated. The plant entered TS 3.0.3 and commenced cooldown at 1332 hours. The NRC was notified at 1405 hours of the TS 3.0.3 entry due

to radiation monitor inoperability and the loss of safety function in accordance with 10CFR50.12(b)(2)(ii).

During this notification at 1405 hours, the NRC was also notified of the termination of the Unusual Event. The Emergency Director had terminated the Unusual Event at 1358 hours with the restoration of the second offsite source of power.

The telecommunications copper line was restored on June 25, 1998, and at 1700 hours on June 29, 1998, the fiber optic line was restored. At 1400 hours on June 28, 1998, only five ENS sirens remained out of service. This brought the total siren system availability to 90.7 percent, above the goal of 90 percent availability.

On June 29, 1998, during feedwater clean-up in preparation for restart, resin was found in the feedwater.

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Apparent Cause of the Occurrence

The storm cell of June 24, 1998, was tracking southeast from Michigan and then eastward along Lake Erie, until suddenly shifting southeast making landfall directly adjacent to the Davis-Besse Nuclear Power Station (DBNPS) site. The DBNPS site was near the center of the storm cell, where cloud elevations and windspeeds were the greatest. The rapidly upward moving air feeding the center of the storm spawned, several funnel clouds, at least one of which touched down onsite and resulted in significant damage to the switchyard and unfortified structures such as outbuildings and roofs. The

tornado was classified by the National Weather Service as an F2 (Fujita Scale) with winds ranging from 113 to 157 miles per hour (mph). The tornado damage resulted in a complete loss of offsite power. The three offsite lines, Ohio Edison, Lemoyne and Bayshore, were all disconnected from the switchyard. Offsite damage was significant, with eleven transmission towers of the Bayshore line destroyed. The EDGs were started prior to the LOOP and supplied their respective essential loads.

The first effects of the storm on the DBNPS facility were detected in the 345kV switchyard at about 2040 hours when air circuit breaker ACB 34561 opened and ACB 34562 opened and closed several times potentially due to lightning strikes. The apparent cause of the opening and closing of ACB 34562 is attributed the proper operation of the automatic breaker reclosing circuitry which is interlocked with synchronizing check relaying and associated lockout relaying. No equipment problems were found with ACB 34562 controls, it functioned as designed.

When the Control Room operators received the report of the funnel cloud on-site, they initiated a manual start of EDG 1 and 2 from the Control Room. The EDG 2 started successfully, but EDG 1 would not start. It was successfully started locally at 2046 hours. The cause of EDG 1 not starting from the Control Room was that Control Room start switch, HS1147B [EK-HS], had worn switch contacts. The switch was replaced and proper operation was verified.

The tornado and accompanying strong straight-line winds did significant

damage to the electrical and telephone infrastructure within five miles of the plant. This damage caused the failure of two of the three available telephone systems that service DBNPS (fiber optic and copper lines). Only the microwave system remained operational. The event was a significant challenge to emergency response facility communications, but the established system was successful in mitigating the event and provided for continued safe operation of the station.

Storm damage from the tornado, strong winds and heavy rain external to the plant property caused severe damage to the Ottawa County electrical distribution system making 40 percent of the sirens in Ottawa County inoperable. A site inspection of the 26 affected sirens indicated no physical damage to any of the sirens. The sirens require 220 volt AC power to operate and failed due to loss of power. Following the storm, power was restored to the sirens.

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Apparent Cause of the Occurrence: (Continued)

The strong winds had significantly damaged the meteorological instrumentation; nine out of 12 meteorological instruments were inoperable. However, the 10-meter meteorological instrumentation for wind speed and wind direction is the primary instrumentation used to perform dose assessment calculations, as required, by the Emergency Plan and three of the four 10-meter instruments were operable immediately following the June 24, 1998, storm. Therefore, sufficient meteorological instrumentation was

available to perform dose assessment calculations, if required.

Additionally, wind speed and wind direction were available from the National Weather Service, which was contacted following the storm to verify meteorological instrumentation as well as to receive the weather forecast.

During the post-trip activities Atmospheric Vent Valve 2 (AVV2) was observed to have a control malfunction. The AVV2 could only either be full closed or opened to 10-14 percent. It was determined that the electro-pneumatic transducer (current to pressure or I/P converter), PY-ICS11A [SB-TD] had failed. The I/P converter was replaced and its function verified on June 28, 1998.

The EDG 1 ventilation failed to maintain the room temperature below the procedurally imposed 120 degrees F operating limit. This resulted in EDG 1 twice being declared inoperable. Even though EDG 1 had been declared inoperable, it did continue to operate and perform its safety function.

The EDG room ventilation system consists of two safety grade, 50 percent capacity supply air fans which automatically start when the EDG is started.

The ventilation system is sized to provide adequate outside air cooling to maintain the operating EDG room at 120 degrees F assuming 95 degrees F outside air per Updated Safety Analysis Report (USAR) Section 9.4.2.1.2.3.

The ventilation system includes safety-grade modulating supply, exhaust and recirculation dampers which are interlocked through a room temperature controller. The dampers automatically modulate to maintain the room temperature between 60 degrees F and 120 degrees F for all operating

conditions per USAR Section 9.4.2.1.2.3. The supply and exhaust air dampers fail closed and the recirculation damper fails open, to prevent freezing temperatures in the EDG room. The initial cause of the EDG ventilation failure to maintain temperature was determined to be a hydramotor failure on the recirculation damper. The ventilation system failed to its safety position of recirculation damper open (freeze conditions). Once the recirculation damper was closed, the EDG room began to cool but subsequently heated up. This heating of the EDG room for the second time is believed to be attributable to the fact that doors were opened and fans placed in the room to improve ventilation and cooling but were, in fact, contributing to the problem by circumventing the designed ventilation system, thus causing the room temperature to increase. However, EDG 1 room temperature remained above 120 degrees F for only approximately two and a quarter hours. A preliminary engineering evaluation has been performed and indicated that EDG operability may indeed not be limited to 120 degrees F, but final determination has not been completed. Further investigation and evaluation of EDG operability at temperatures above 120 degrees F and the EDG room ventilation system is still ongoing.

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Apparent Cause of the Occurrence: (Continued)

The plant had entered the Emergency Plan in response to a tornado striking the facility and experienced a subsequent LOOP. The LOOP resulted in the

loss of forced RCS flow and the loss of normal secondary side feedwater sources necessitating establishment of natural circulation cooling. The maximum cooldown rate allowed by procedure is 10 degrees F per hour. This procedural cooldown rate limit was developed to prevent drawing a steam bubble in the Reactor Head which would have the potential for disrupting natural circulation. The plant was in Mode 3 and had two methods of cooling available; natural circulation using the steam driven AFP and Motor Driven Feed Pump (MDFP) [BA-P] and Decay Heat (DH) removal using essential 4160 volt power. Because of the LOOP, the DH pumps would be powered from the EDGs. The uncertainty of the operability of the EDGs lead the ERO to determine that it would be more conservative to comply with the procedural guidance for natural cooldown and maintain two viable options to cool the reactor.

Inoperability of EDG 1 with no offsite source available necessitated entry into TS 3.0.3 requiring a RCS cooldown below 280 degrees F (Mode 4 HOT SHUTDOWN) within seven hours. Due to plant conditions, the ERO determined that the plant would be in the safest configuration if not cooled at a higher cooldown rate than allowed by procedure to comply with the TS 3.0.3 requirements. Operators conservatively continued to cooldown the plant near the maximum cooldown rate allowed procedurally (10 degrees per hour), but did not meet the TS 3.0.3 requirement. At 1913 hours on June 25, 1998, the Shift Supervisor invoked the provisions of 10CFR50.54(x) that allows for departure from TS requirements in emergency situations.

On ATTACHMENT 1 TO 9808260104 PAGE 1 OF 1

First Energy Davis-Besse Nuclear Power Station

5501 North State Route 2

Oak Harbor, Ohio 43449-9760

NP-33-98-006

Docket Number 50-346

License Number NPF-3

August 21, 1998

United States Nuclear Regulatory Commission

Document Control Desk

Washington, D.C. 20555

Ladies and Gentlemen:

LER 1998-006

Davis-Besse Nuclear Power Station, Unit No. 1

Date of Occurrence - June 24, 1998

Enclosed please find Licensee Event Report 1998-006, which is being submitted written notification of the subject occurrence. This LER is being submitted in accordance with 10CFR50.73(a)(2)(i), 50.73(a)(2)(iii), 50.73(a)(2)(iv) and 50.73(a)(2)(v).

Very truly yours,

James H. Lash

Plant Manager

Davis-Besse Nuclear Power Station

CAK/dlc

Enclosure

cc: Mr. A. B. Beach

Regional Administrator

USNRC Region III

Mr. Stephen J. Campbell

DB-1 NRC Senior Resident Inspector

Utility Radiological Safety Board

*** END OF DOCUMENT ***
